Notes for — By Dr. Bharat Singh
B.Sc. Part-III : H.O.D. Physics.
Paper - 5th (Q.M) : Concept of State.

Schrodinger's Concept of State :— In classical mechanics a physical system is described completly by the co-ordinates and velocities of all its constituent particles. Such a discription in impossible in quantum mechanics. Because the co-ordinates and corresponding velocities or momenta have to obey uncertainity relation. Any description of the state of a quantum system arises as a result of some measurments.

There are two types of measurments ~~such~~ ~~that~~ in quantum mechanics. In one the majority of measurments do not lead with certainity to a unique result. The other class contains measurments such that for every possible result of measurment there is a state in which the measurment leads with certainity to that result. Such measurments play an important part in quantum mechanics and is known as predictable. If in some state a measurment gives with certainity a unique result, we say that in this state the corresponding physical quantity ~~has~~ has a definete value.

We know that in quantum mechanics every set of physical quantities can not be measured simultenously. ~~Such sets are called complet sets.~~ ~~An~~ An important part is played by a set of physical quantities that can be measured simultenously. Such sets are called complet sets. →

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→ All quantities of a complete set can be measured simultaneously, but no other physical quantity which is not given complet set can have a definit value.

Now let us formulate the measuring of complete discription of a state in quantum mechanics. completly described states occurs as a result of the simultenous measurment of complete set of physical quantities. From the result of such measurment we can determine the probability of varieus results of any subsequent measurment regardless of the ~~system~~ history of the system prior to the first measurment. By the state of a quantum system we shall always mean completly described state.

For determining the state of an electron, the following complete set are employed :- (I) x, y, z, σ (II) p_x, p_y, p_z, σ and (III) E, l, m, σ where x, y, z are the position co-ordinates, p_x, p_y, p_z are the corresponding components of momentum, E is the energy and l, m and σ are orbital magnetic and spin quantum number respectively.

For determining the state of a photon the following complete sets are employed : (1) K_x, K_y, K_z and α and (II) E, M^2, M_z, P where K_x, K_y, K_z are the projections of the wave vector of the radiation. α is the polarisation of the photon. M^2 and M_z are the square of the momentum and the projection of the momentum along z-direction and P is the spatial parity which can assume one of the two values $+1$ and -1.

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